METHOD AND COST OF DRIVING THE ROCK CREEK TUNNEL, HECLA MINING CO. SHOSHONE COUNTY, IDAHO

BY D. W. BUTNER

* * * * * * * * * * Information Circular 7525

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INTRODUCTION AND SUMMARY

This report is one of a series of Information Circulars, issued by the Bureau of Mines, describing mining methods and costs at mining operations of unusual interest. It deals with driving the Rock Creek tunnel by the Hecla Mining Co. in the Coeur d'Alene district of Idaho.

The tunnel is on the south side of the Osborn fault and east of the Coeur d'Alene Silver Belt, as described by Shenon and McConnel.[2] There are no producing mines in this part of the district, a fact that would enhance the significance of any ore bodies discovered by the project. The work was undertaken by the Hecla Mining Co. after favorable geological evidence was discovered in trenches cut in the ridge above Rock Creek. The lowest practical position was chosen as the starting point. Driving of the tunnel was begun February 1, 1948. Tentatively, the objective was placed at 4,000 feet from the portal. On August 31, 1948 the face of the tunnel was 4,483 feet in; it had been advanced at an average rate of 21.05 feet per day for the 213 days since the work began. Three shifts per day, of three men each, worked 7 days per week on contract. The company provided tools, supplies, and the necessary labor on the dump. The direct cost of driving the tunnel was $18.26 per foot; all underground and surface labor, $13.02, powder and primers, $3.82, bits and rods, $0.91, and power, $0.51.

ACKNOWLEDGMENTS

This report was prepared under the direction of S. H. Lorain, chief of the Mining Division at the Bureau's Albany Branch. Thanks are due L. E. Hanley, president of Hecla Mining Co., for permission to publish details of the work. The cooperation of R. W. Neyman, superintendent of the Hecla Mining Co., as well as of J. W. McDonald, foreman of the Rock Creek tunnel, is gratefully acknowledged.

1/ Mining engineer, Albany Branch, Bureau of Mines.

2/ Shenon, P. J., and McConnel, R. H., Silver Belt of the Coeur d'Alene District, Idaho: Pamphlet 50, Idaho Bureau of Mines and Geology, May 1939.

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LOCATION

The Rock Creek tunnel is in the Hunter Mining District of the Coeur d'Alene region in Shoshone County, Idaho. The portal is a few hundred feet south of U. S. Highway 10, 3.5 miles east of Wallace, where Rock Creek joins the South Fork of the Coeur d'Alene River, at an altitude of about 3,000 feet. The site is shown on the map in figures 1 and 2. The area in which the work is being done is less than a mile south of the Osborn fault; it is 5 miles east of the Silver Belt.4/ Sorenson5/ refers to the Rock Creek vicinity as the East Silver Belt.

OBJECTIVE OF THE TUNNEL

Trenching by bulldozer on a ridge above Rock Creek disclosed a zone of sericitization 500 to 600 feet wide, in which there was evidence of mineralization. This type of alteration commonly is found enclosing ore bodies in the Coeur d'Alene area, though it is not restricted to the vicinity of ore. The tunnel is being driven to investigate the sericite zone, which should be intersected about 4,400 feet from the portal at a depth of 700 feet below the surface. Most of the new ore recently developed in the Silver Belt has occurred at much greater depths. Some of this deep ore was developed under Hecla management, and the experience thus gained will be helpful in the interpretation of conditions found at the intersection of the tunnel and the bleached zone.

The practice of driving long adit levels to intersect potential ore-bearing formations at depth is usual in the Coeur d'Alene district. The adit provides a means of close examination of the beds in question and is a platform from which to prosecute further exploration laterally, or in depth, by drifting, sinking, or core drilling; it also facilitates year-round operation. Diamond drilling is used throughout the district for investigating geologic structures, but there is general reluctance to depend on core-drill results for ore exploration.

Production by the mines of the Silver Belt from 1904 to 1947, inclusive, is given by the Economic and Statistical Division of the Bureau as follows:

Ore treated, tons	Fine ounces		Pounds		
	Gold	Silver	Copper	Lead	Zinc
4,588,193 ..	4,429	126,401,125	37,877,372	52,048,231	1,120,525

It is interesting to note that no production of zinc from this ore was reported prior to 1937 and none for 1938, 1939, 1940, 1942, and 1944. In 1947 recovery of 451,070 pounds was recorded. Such an output indicates the potential importance of hitherto undiscovered ore bodies in this part of the Coeur d'Alene region. Rock Creek tunnel is being driven in an effort to find such deposits.

3/ Work cited in footnote 2.

4/ Sorenson, R. E., Deep Discoveries Intensify Coeur d'Alene Activities: Eng. and Min. Jour., October 1947, p. 77.

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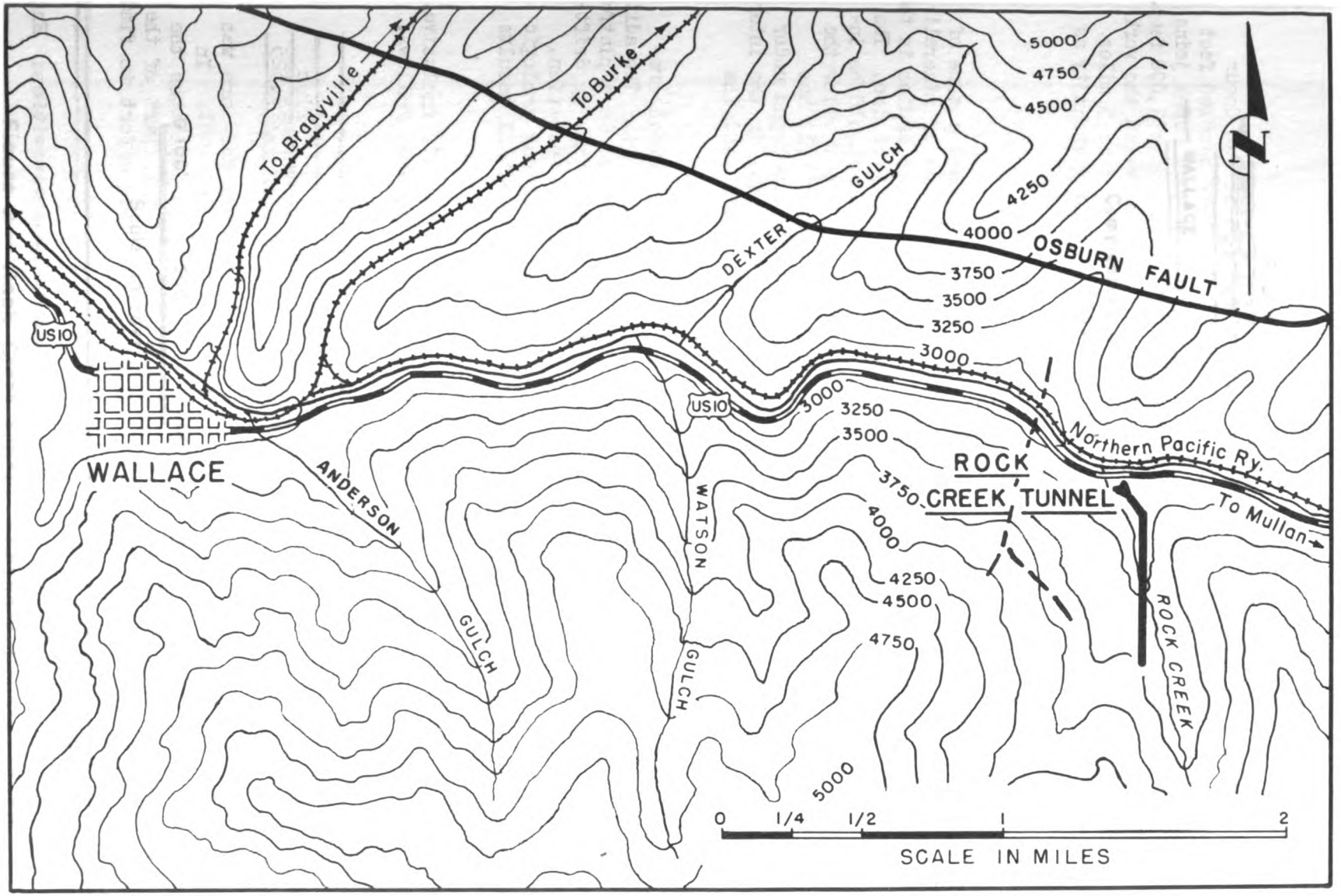

Figure 1.– Location map, Rock Creek tunnel, Shoshone County, Idaho.

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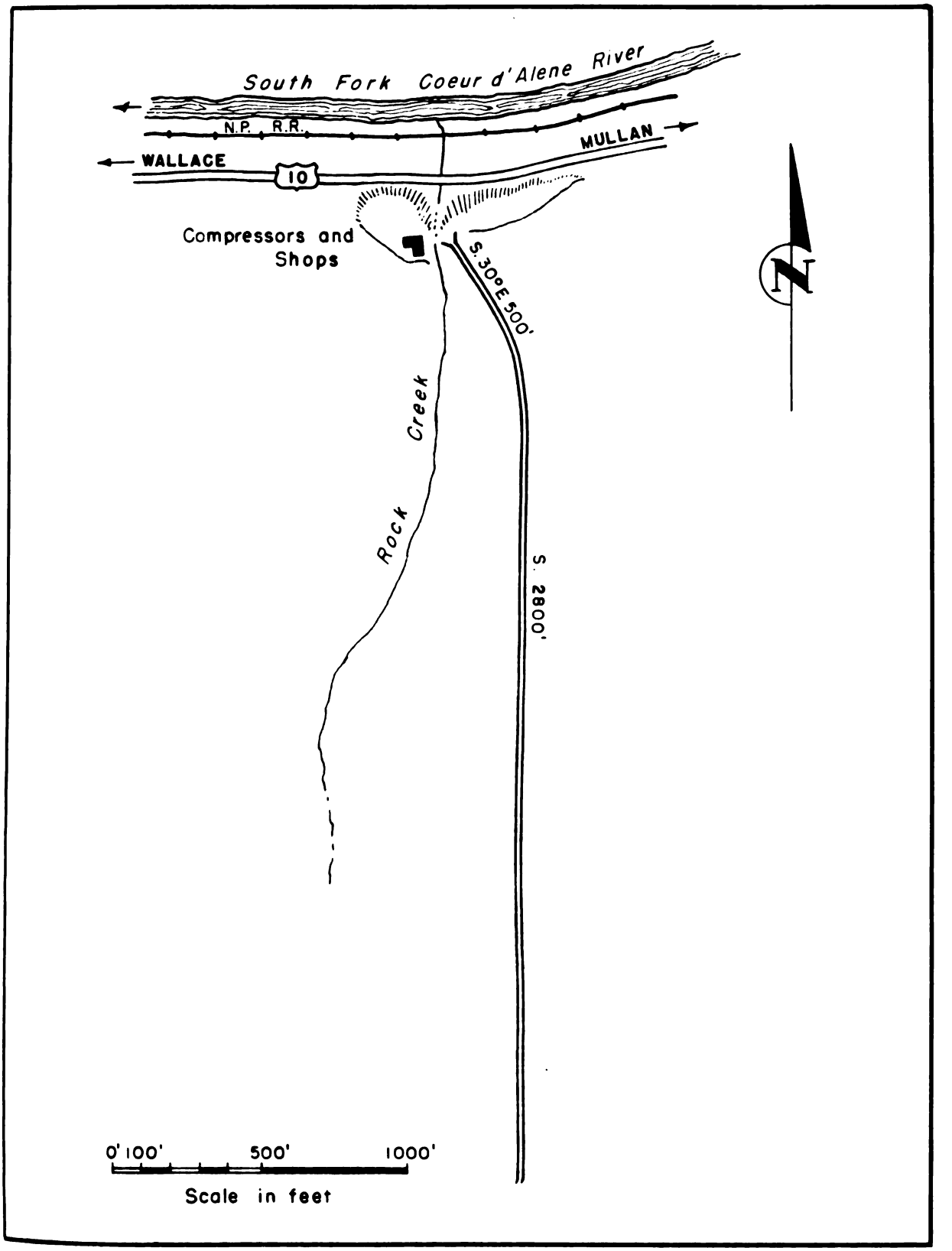

Figure 2.— Rock Creek tunnel, Shoshone County, Idaho.

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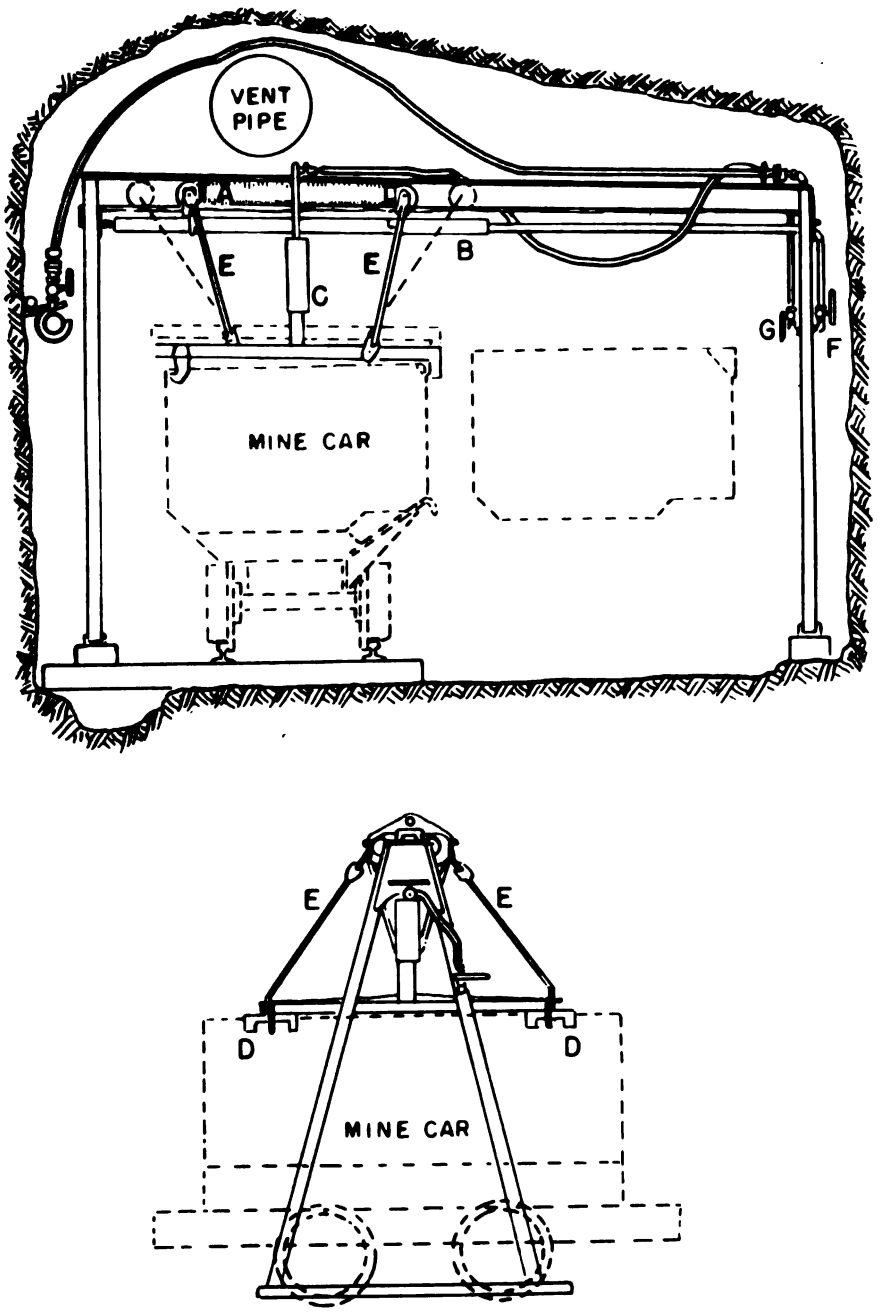

A - Hoisting cylinder (One on each side of H-beam).
B - Transverse movement cylinder.
C - Vertical pusher cylinder.
D - Hook engaging units.
E - Hanger rods.
F - Valve for transverse cylinder.
G - Valve for hoisting cylinder

COEUR D'ALENE
H.&F.CO., WALLACE

Figure 3. - Neyman car shifter.

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GEOLOGICAL FORMATION

The rocks of the Coeur d'Alene district are pre-Cambrian sediments of the Belt series. From the base of the series, the formations are the Prichard, Burke, Revett, St. Regis, and Wallace. The tunnel has penetrated the St. Regis beds of quartzite and argillite. Most of the Silver Belt ore bodies are in the St. Regis formation; most of the lead or lead-zinc mines of the Coeur d'Alene District are in the Revett or Burke quartzites. Recent ore discoveries in the Sunshine, Chester, and Silver Summit properties in the Silver Belt have been made at depths of several thousand feet below outcrops that were considered unpromising a few years ago. Hence, it will be necessary to explore the Rock Creek zone below the tunnel level in order to complete the investigation.

EQUIPMENT AT TUNNEL

Compressed air for the work is supplied by a compressor having a capacity of 467 cubic feet per minute. This compressor is driven by a 100-horsepower, 2,200-volt, induction motor. A 315-cubic foot compressor with a 75-horsepower motor is kept ready as an emergency standby. Power is furnished by the Washington Water Power Co. at 13,000 volts. The voltage is stepped down to 2,200 volts by a bank of transformers near the portal. Shop equipment is housed with the compressors at the portal.

A motor-generator set is driven by a 50-horsepower, 2,200 volt motor to furnish 250-volt direct current on the trolley for powering the 4-ton locomotive used in the tunnel to pull Coeur d'Alene-type, 50-cubic-foot, side-dump cars to the surface. The cars are loaded by a power shovel; they are switched by means of a 1-1/2-ton battery motor and a cherry picker of improved design. This cherry picker, called the "Neyman side-stepper," can shift a car either way in 8 seconds; its design is shown in figure 3. It was devised by R. W. Neyman, superintendent of the Hecla Co. The car is lifted by a toggle motion actuated by two compressed-air cylinders. The suspended car is moved to one side, clear of the track, and back again in exact position to be lowered to the rails. The car can not swing or turn while being shifted. A patent on the apparatus has been applied for.

Before each round is fired, an armored carriage housing an air-driven fan is pushed near the face and connected to air and water lines. After the round is fired, the fan directs a powerful stream of air and three fine sprays of water to the face. The water sprays are blown in as a fog, which is effective in removing gas and smoke as wall as dust. The use of this "battery," as it is called, materially reduces the time lost in clearing powder smoke from the heading. The "battery" was designed by R. W. Neyman and built by the Hecla Mining Co.

Ventilation is effected by a Coppus Ventair No. 8 blower driven by a 15-horsepower motor placed at the portal. The locally made ventilation pipe is 19 inches in diameter; it has a groove rolled around the circumference on the male-joint surface of each section. Cotton cord or small cotton rope is laid in the groove when the pipe is coupled, making a tight but flexible joint.

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Used cord is put in the joint grooves as a matter of economy. The sections are fastened together with 4 bolts through flanges set back from the ends.

The tunnel track has 24-inch gage and 30-pound rails. Water is conveyed to the face in 2-inch pipe. Compressed air is conveyed by a 4-inch invasion pipe line. Electrical lines, except trolley and blasting circuit, have not been installed underground.

A Cleveland 2-boom jumbo drill carriage is used to mount 30 inch change DA-30 automatics with New York back head at the face.

Detachable bits are used. Bit gages are 1-7/8 inches on starters, 1-3/4 inches on seconds, 1-5/8 inches on thirds, and 1-1/2 inches on finishers. Bits are sharpened by grinding in the tunnel shop. They are ground 4 to 5 times to even 1/16-inch gage before being discarded.

CYCLE OF OPERATIONS

The cycle of operations begins when the drill carriage is pushed to the face. There the jumbo is fastened to track, and a V-cut round is drilled, usually to a depth of 7 feet but occasionally to 9 feet. When drilling is finished, the carriage is withdrawn and the round is loaded with 45-percent dynamite. Before the blast is fired, the "battery" is moved up to a point 30 to 35 feet from the face and clamped to rails. Before the round is fired, air and water valves are opened, and the battery blows air and spray to the face. The air in the heading is cleared rapidly, and the amount of smoke held in the muck pile is reduced. When the face is cleared of smoke, the battery is moved back, and the shovel is brought to the heading. Mucking takes more time than any other operation in the cycle; consequently, much care is taken to promote efficiency. The time-saving, improved cherry picker is the most notable development in the effort to speed the process. After all broken rock is cleaned out of the heading and the shovel is removed, track and pipe lines are extended; then the cycle begins again.

A time study by the Hecla engineers has been the basis for a distribution of the miner's time, as follows:

Work	Percent of time
Setting up	6-1/2
Drilling	26
Loading, blasting, and blowing	12
Mucking	35-1/2
Track and ditch	12
General and pipe	8
	100

TUNNELING OPERATION

The tunnel was driven S. 30° E. 500 feet; then it was turned directly south. The section is roughly elliptical; its maximum breadth is 7 feet

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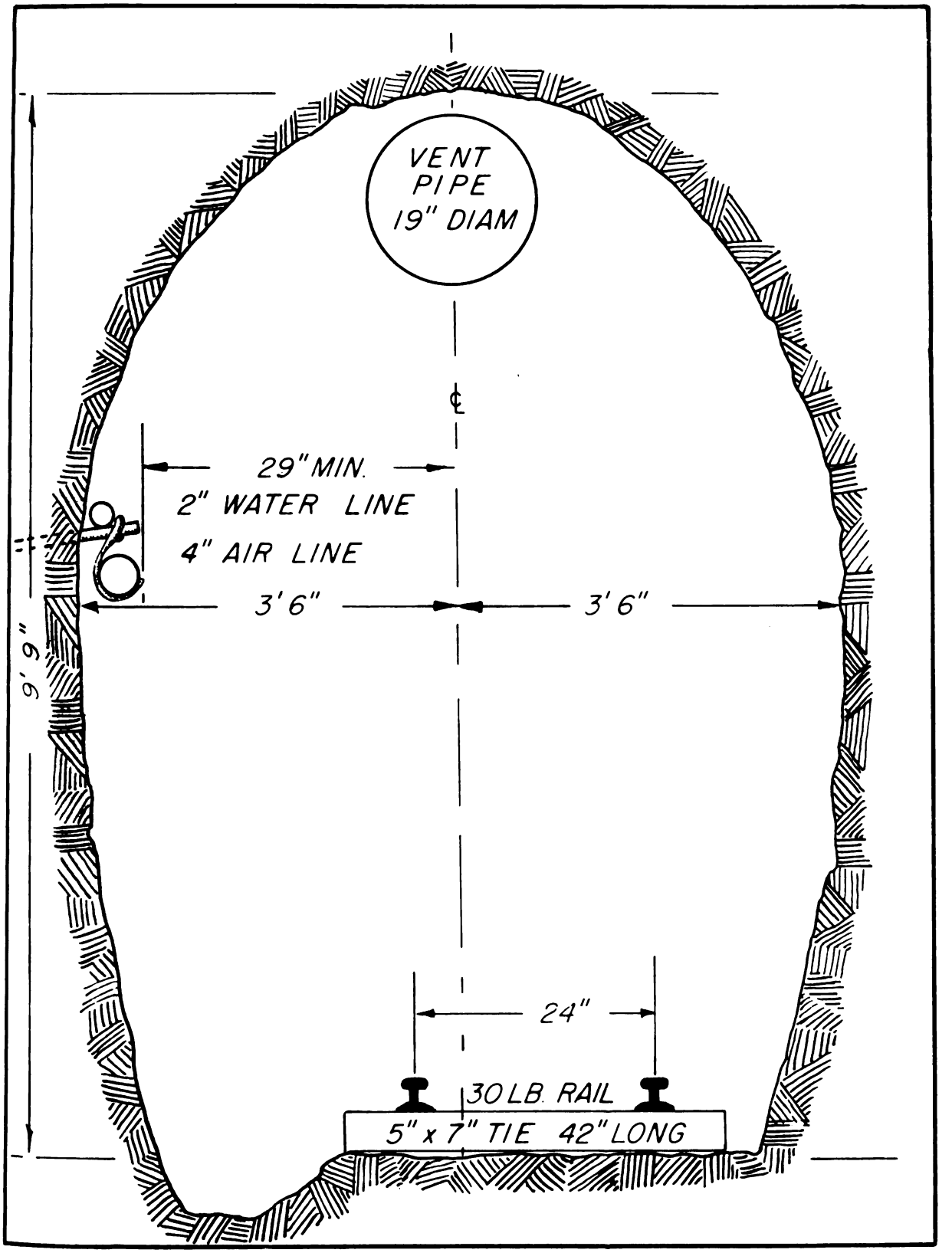

Figure 4. — Typical section of Rock Creek tunnel.

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and its maximum height is 9 feet 9 inches. A ditch 6 inches deep is cut between the track ties and the east wall, as shown in figure 4. Except for a few pockets, very little water has been encountered in the formation. The rock through which the tunnel has been driven is quartzite with interbedded argillites. With the exception of the portal sets, no timber has been used.

Driving the tunnel has been done on labor contract; three men on each of three shifts work 7 days per week, do all underground work, drill, blast, muck, lay track, install pipe, and operate haulage. The company furnishes all equipment, supplies, and power and the necessary outside labor, including mechanical upkeep.

The tunnel was started February 1, 1948. On August 31, 1948, after 213 days, the heading had been advanced 4,483 feet, an average of 21.05 feet per day. The best record was made in August, when the average daily advance for the month was 25.43 feet.

Each foot the face was advanced filled 2.46 cars with rock, used 18.76 pounds of explosive, and required 4.82 bits and 3.47 man hours of work.

The average advance made by each round blasted was 6.56 feet; the average round required 30 holes.

COSTS

Direct mining costs per foot of advance for the Rock Creek tunnel, over 4,483 feet, are as follows:

	Labor[1/]	Super-vision	Compressed air drills, and steel	Power	Explosives	Total
Underground	10.21	0.71	0.91	0.51	3.82	16.16
Surface	2.10					2.10
	12.31	.71	.91	.51	3.82	18.26

1/ During this period, the daily rate for miners working on company account in the Coeur d'Alene district was approximately $11 per day.

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